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ABSTRACT

The advantages, feasibility and problems asscciated with a student-paced course were investigated, and a computer managed evaluation system compared to paper and pencil testing mode. The development of a self-paced course was facilitated by explicit behavior objectives, a variety of learning materials referenced to the objectives and a large pool of test items. The advantages of the self-paced course, which was given in an otherwise fixed curriculum, included a moderate reduction in student completion time, more uniform mastery of the objectives, less conflict with other courses, a strongly positive student attitude, and more use of faculty for problem-solving learning experiences compared to information transfer. Problems in operating the course were mainly associated with the administration, grading and providing feedback on 2,000 individual tests. Half of the tests were administered on cathrode ray terminals utilizing Course-writer III language with disk storage of all student responses and score.. Major advantages of the computer administered tests over paper and pencil tests included immediate feedback to students, production of summaries of student performance and attitudes without manual manipulation of paper or figures, and less worry about test security. By the end of the course, students preferred the computer to paper and pencil tests. (Author/CK)

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## ABSTRACT

# DEVELOPMENT OF A STUDENT-PACED COURSE IN GENERAL PATHOLOGY UTILIZING A COMPUTER MANAGED EVALUATION SYSTEM

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The advantages, feasibility and problems associated with a student-paced course were investigated and computer managed evaluation system compared to paper and pencil testing mode. The development of a self-paced course was facilitated by explicit behavior objectives, a variety of learning materials referenced to the objectives and a large pool of test items. The advantages of the self-paced course, which was given in an otherwise fixed curriculum, included a moderate reduction in student completion time, more uniform mastery of the objectives, less conflict with other courses, a strongly positive student attitude, and more use of faculty for problem solving learning experiences compared to information transfer. Problems in operating the course were mainly associated with the administration, grading and providing feedback on 2000 individual tests. Half of the tests were administered on cathrode ray terminals utilizing Coursewriter III language with disk storage of all student responses and scores.

Major advantages of the computer administered tests over paper and pencil tests included immediate feedback to students, production of summaries of student performance and attitudes without manual manipulation of paper or figures, less worry about test security and less supervisory time required. Problems with computer administered tests included terminal and computer shutdowns and costs. By the end of the course students preferred the computer to paper and pencil tests. Scores and time were the same for the two testing modes.

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# DEVELOPMENT OF A STUDENT-PACED COURSE IN GENERAL PATHOLOGY UTILIZING A COMPUTER MANAGED EVALUATION SYSTEM

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Two years ago at the RIME Conference the development of a General Pathology course based on specific behavioral objectives and a criterion referenced evaluation system was reported (1). The learning materials for the course had been developed to a degree that we felt many students could proceed through the course at a pace faster than the usual course schedule. The ultimate benefits of self-pacing would require flexibility in most parts of the curriculum and would allow many students to save some time in medical school and some students to reach higher levels of competence by spending more time than is presently allowed. The benefits of self-pacing a few courses is less, but does free some student time for other activities or pursuit of some topics in depth and serves to iron out competition between courses created by fixed examination times. The purpose of the present project was to determine feasibility, costs and problems associated with a self-paced course and to compare computer administered with paper and pencil tests.

COURSE ORGANIZATION: The course is divided into three semi-independent parts, each with its own learning objectives, learning materials and evaluation instruments. The intent of the first part of the course is to make knowledge acquisition easy and efficient with a high level of mastery. This part of the course is divided into nine topic units and requires approximately two-thirds of the student's effort. All of the required information is available in written form with reference to the most appropriate source appended to each of the 100 objectives of this segment of the course. These written materials include a choice between two standard textbooks with page references for appropriate objectives, 13 programmed text units (2) covering three of the largest units in detail, and 21 handouts covering parts of all units. In addition a series of 28 lectures is provided which suggests an average pace for the course and is designed to emphasize the importance of various topics, discuss frequency of various disease processes and their causes, present a few difficult topics (such as hemostatic disorders) and show gross photographs.

The second segment of the course, called case analysis, requires approximately one fourth of the student's effort for the course and is directed toward correlating skills in microscopic observation with judgements on data presented in short typical case histories involving 25 basic disease processes. The learning experience consists of 48 histories with microscopic slides which the students practice analyzing in small groups with the assistance of an instructor. The intent of this segment is the acquisition of problem-solving skills in situations that simulate those they will encounter in the practice of medicine.

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The third segment, entitled introduction to the use of the laboratories, comprises about one-twelfth of the student's effort and is designed to concern students with laboratory costs, quality control procedures, factors which affect laboratory test results, roles of laboratory personnel and availability of laboratory procedures in various types of hospitals. The learning experience consists of a tour of each of seven laboratory subdivisions and handouts to provide the appropriate factual information. We felt that our students previously lacked sufficient orientation and knowledge of laboratory operations to make maximum use of them.

COURSE EVALUATION SYSTEM: The evaluation system is designed to fulfill two purposes: 1) to provide feedback to the student on his progress and encourage him to perform at the mastery level and, 2) to provide feedback to the department concerning parts of the course that need improvement. The system is set up to provide formative (practice) and summative (final) tests for each segment of the course including each of the nine didactic units. The major problems involved in setting up this system include: having enough test items specifically referenced to course objectives to provide for formative and alternate forms of summative tests, maintaining test security, administering a minimum of 2000 individual tests, and analyzing test and questionnaire data.

The evaluation system for the case analysis segment of the course has been self-paced since its inception two years ago. A pool of test cases covering 25 basic disease processes in 11 organs is used to make up a series of 10 item tests. The same sets of cases serve as formative tests as there is only a few points penalty for failure on the first try, and, in fact, about one-third of the students need to take the test more than once.

The nine didactic unit exams, the final exam for the didactic units and the introduction to the use of the laboratories exam consist of multiple choice test items. We had planned to administer all of these tests on paper and pencil, but 6 weeks before the start of the course we found enthusiastic support from the University Computer Center and financial support from the Dean to develop a computer managed evaluation system for the multiple choice items. A lack of sufficient number of cathrode ray terminals (CRT's) during the first half of the course led us to assign the students on alternate units to paper and pencil testing mode and observe the differences in the two modes.

The computer system utilized Coursewriter III language and an IBM 360/65 computer. The computer was programmed to store on disk all student responses to test questions and questionnaire items and unit test scores. The program allowed the instructor to display on the terminals student test scores and individual responses to test questions. The questionnaire responses were programmed to remain anonymous while still allowing the computer to correlate attitudinal data with performance data.

The problem of sufficient test items was solved by our systematic collection of items with data from previous years, by a developing pathology test item pool among several schools by an informal organization called Group for Research In Pathology Education (GRIPE), and by creation of a limited number of new questions. Three equivalent exams with items proportion to the objectives were developed for each of the 9 didactic units and the introduction to the laboratories segment. Four forms of the 32 item final didacitc exam were developed. Each item was assigned a minimum pass level as described by Taylor et al (3). Except for the final didactic exam, one of the exams served as the formative test and was given to the students with an answer key, minimum pass level and mastery level. The other two exams serve as alternate forms of the summative exam.

The problem of test security was partially solved by the CRT administered tests which prevented circulation of hard copy of tests and displayed the test item only when it was being answered. Initially we did not give the student the answers to test items but provided a key phase (mini objective) at the end of the test for each item missed. The students complained about not being able to see the correct answer, so we altered the computer program to display the correct answer after each student response. Security was maintained on paper and pencil test by having a limited number of test copies and by close supervision of the testing room, but we had no indication that the students were trying to beat the system.

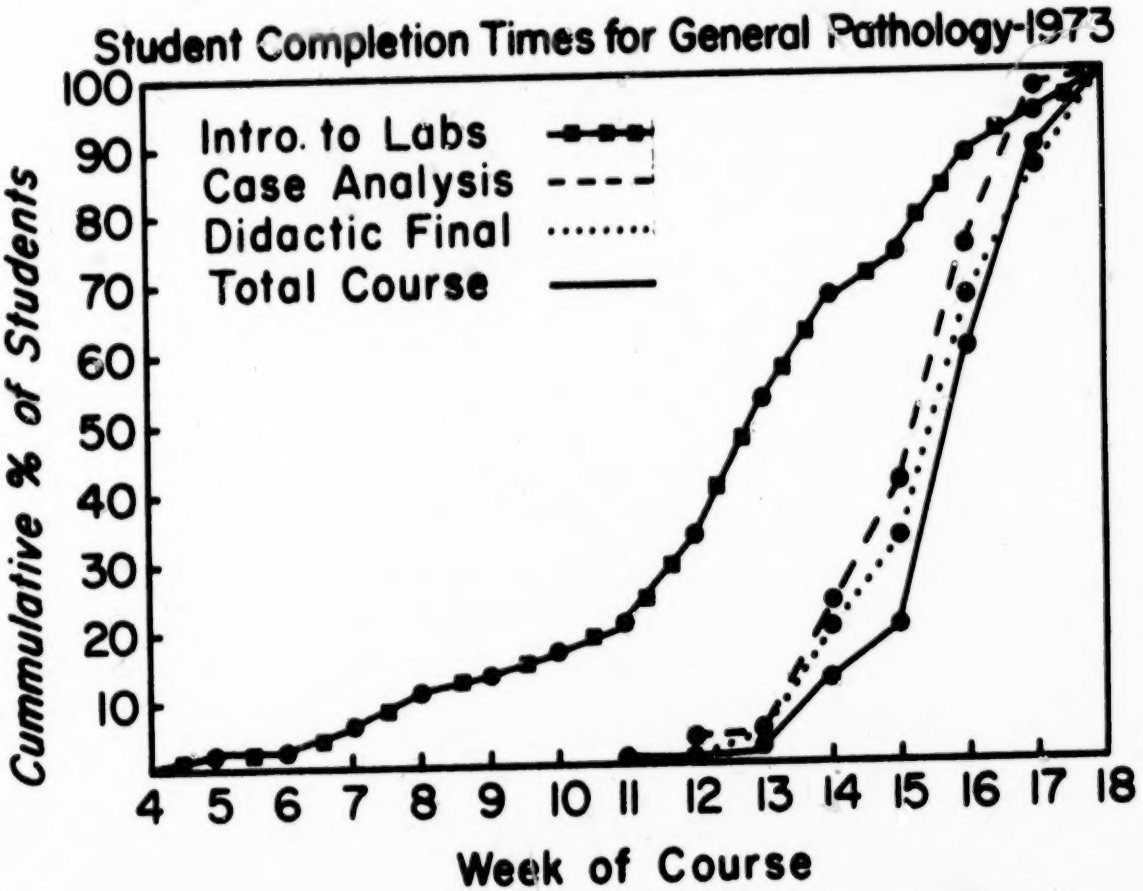
The problem of administering 2000 individual tests was a major one and required the hiring of an additional half-time test room supervisor. However, this problem was greatly reduced in the last half of the course when we had more CRT's and students had learned how to operate the terminals without help.

The problem of test grading and data analysis was different for the paper and pencil and CRT administered exams. The paper and pencil tests required hand grading and individually showing students the items they missed. At the end of the course the collective data was easily processed by our examination service but had to be translated to summary data sheets by hand. The CRT administered exams provided immediate feedback including the correct answer after each question, and, at the end of the test, the student's score, the minimum pass level, mastery level and key phrases for each item missed. Programming the computer to store and retrieve the student performance and questionnaire data required considerable effort, but provided summaries that did not require further transfer of data.

RESULTS: It would be difficult to say that students achieved at a higher level than in previous years, although the data in Table 1 suggests that there was more uniform achievement of mastery in the self-paced unit oriented course of 1973 than in the paced 1972 course with midterm and final exams.

Table 1. Percent of Students Achieving Mastery and Failing on First Try for 1972 and 1973

| | | % Mastery on First Try | | % Fail on First Try | |
|---|---|---|---|---|---|
| | | 1972 | 1973 | 1972 | 1973 |
| Didactic Unit | 1 | 72 | 93 | 0 | 0 |
| | 2 | - | 73 | - | 3 |
| | 3 | 59 | 33 | 2 | 8 |
| | 4 | 80 | 74 | 1 | 2 |
| | 5 | 51 | 83 | 6 | 2 |
| | 6 | 36 | 79 | 1 | 3 |
| | 7 | 70 | 80 | 1 | 3 |
| | 8 | 39 | 91 | 3 | 0 |
| | 9 | 90 | 78 | 0 | 0 |
| Intro to Labs | | 38 | 80 | 0 | 1 |
| Case Analysis | | - | - | 47 | 34 |



The week of the course in which students finished various segments and the whole course is shown in the figure. The students were explicitly told they had to finish in the allotted time for the course. One student required an extra day. As indicated in the figure, approximately 10% of the students finished 4 weeks early, 20%, 3 weeks early and 60%, 2 weeks early.

The student attitude toward the course was strongly positive with all types of learning experiences and all instructors receiving an average or better rating. Programmed texts and case analysis discussions rated the highest. Eighty-nine percent of the students preferred self-paced unit testing compared to 2% for paced unit testing, 2% for self-paced midterms and finals, 1% for scheduled midterm and final, and 6% not responding.

The computer administered tests initially created a negative student response. The attitude became positive in the second half of the course when many problems involving terminals, programming, computer shutdowns, and familiarity with the system were resolved. At the end of the course 41% of students definitely preferred the computer mode, 42% said either mode was acceptable with half slightly favoring each mode, and 15% definitely preferred paper and pencil testing. Mean test scores for computer and paper and pencil administered tests were not statistically different and the time required to take the test was not different except for the first time on the computer terminal in which there was a pretest used to instruct students to use the terminal.

Ninety-eight percent of the students indicated that they used the formative tests, 69% using them after completing studying of the unit, 19% using them before completing study of the unit and 10% using them in a variable fashion.

DISCUSSION: The major short term gain in this experimental student-paced course was a mild reduction in time required for students to complete the course, more uniformity in the degree of mastery of the various units, and a strongly positive student attitude toward self-pacing. The long-term gains are more difficult to substantiate objectively. If students could be freed from the lock-step requirements of other parts of the curriculum, the course could be run on a year around basis. Faculty effort for course preparation is progressively reduced as parts of the course become more refined. This allowed redirection of faculty effort toward interaction with students in problem solving situations and toward ongoing course evaluation and critique. Two students who completed the course early gained additional experience in the surgical pathology laboratory. In the future more students will be given advanced opportunities.

The cost of the course was somewhat increased over previous years.

The amount of faculty effort was not changed, although more concentrated with the course director who gave most of the lectures and developed the evaluation instruments. Nearly the entire faculty, including visiting faculty, were involved in the case analysis and introduction to the laboratories segment of the course. The computer administered evaluation system cost approximately $30 per student including programming, computer time, terminal rental and part-time secretarial help. This cost can be reduced by capital investment in terminals and finding more efficient means of sharing computer time; after debugging, programming and secretarial time can be reduced to a minimum. We have no good estimate of previous costs in terms of faculty and secretarial time for preparation, administration and analysis of exams. The cost of secretarial time for individually administered paper and pencil tests is considerable.

The Coursewriter III test administration system with student record storage can be interfaced with a computerized test item bank, so that, a course evaluation administration system can be created merely by specifying test item numbers and student identification numbers for the course. We feel that faculty effort can be reduced to decision making about appropriateness of individual test items, adding an occasional new item to suit new objectives, and evaluating computer prepared summaries of student and test item preformance. Secretarial time should be reduced to adding a few new test items, typing a series of numbers to define the tests for the course and being available in the testing center to solve problems that arise.

REFERENCES:


1 Kent TH, Penick GP: Value of behavioral objectives and performance standards in a general pathology course. Proceeding Tenth Annual Conference on Research in Medical Education, AAMC, Nov. 1, 1971

2 Kent TH, Taylor DD, Buckwalter JA: Field test of programmed texts for teaching general pathology. J Med Ed 47: 873-878, 1972

3 Taylor DD, Senhauser DA, Shively JA, Reid JC: The use of minimum pass level techniques on departmental examinations in pathology. J Med Ed 45: 823, 1970